What is claimed is:

1. A microfluidic device, comprising:

a microchannel having an interior bounded by a side wall; and

a fluid interface port formed in the side wall of the microchannel to provide access to the interior of the microchannel, wherein the fluid interface port has a diameter between about 25 μm and about 100 μm, such that when a fluid is disposed in the interior of the microchannel, the fluid forms a virtual wall at the fluid interface port.

2. The microfluidic device of claim 1, wherein the microchannel has a diameter, and the diameter of the fluid interface port is substantially equal to the diameter of the microchannel.

3. The microfluidic device of claim 1, wherein the fluid interface port has an inner wall comprising a material that is repellent to the fluid disposed in the interior of the microchannel.

4. The microfluidic device of claim 3, wherein the material comprises a hydrophobic material.

5. The microfluidic device of claim 1, wherein an interior surface of the side wall of the microchannel is attractive to the fluid disposed in the interior of the microchannel.

6. The microfluidic device of claim 5, wherein the interior surface of the side wall is formed of a hydrophilic material.

7. The microfluidic device of claim 1, further comprising a covering layer disposed over the fluid interface port for covering the fluid interface port.

8. The microfluidic device of claim 7, wherein the covering layer comprises a covering fluid that is immiscible with the fluid disposed in the interior of the microchannel.

9. The microfluidic device of claim 7, wherein the covering layer comprises a non-evaporating liquid.

10. The microfluidic device of claim 1, further comprising a second fluid interface port formed in the side wall of the microchannel, such that when a fluid in the interior of the microchannel, the fluid forms a virtual wall in the second fluid interface port.

11. The microfluidic device of claim 10, wherein the fluid interface port forms an injection port for receiving a sample and passing the sample into the interior of the microchannel, and the second fluid interface port forms an ejection port for ejecting a sample from the microchannel.

12. The microfluidic device of claim 1, further comprising a droplet generating system for forming a droplet of the fluid and for introducing the droplet to the channel through the fluid interface port.

13. The microfluidic device of claim 12, wherein the droplet generating system comprises a droplet carrying element for carrying the droplet.

14. The microfluidic device of claim 12, wherein the droplet carrying element comprises a pin for introducing the droplet to the fluid interface port by contacting the virtual wall.

15. The microfluidic device of claim 1, further comprising an optical detector disposed relative to the fluid interface port for optically detecting the fluid through the virtual wall formed in the fluid interface port.

16. The microfluidic device of claim 1, further comprising an array of fluid interface ports forming a plurality of virtual walls, wherein the array of fluid interface ports wicks an externally applied second liquid into the microchannel.

17. The microfluidic device of claim 1, wherein the fluid interface port has a cylindrical or conical shape.

18. The microfluidic device of claim 1, further comprising a first fluid disposed in the interior of the channel and forming a virtual wall in the fluid interface port.

19. The microfluidic device of claim 1, wherein the fluid interface port is adapted to allow the bi-directional exchange of fluid with the microchannel through the fluid interface port.

20. The microfluidic device of claim 1, wherein the microchannel is non-linear in shape.

21. The microfluidic device of claim 20, wherein the microchannel is substantially U-shaped.

22. The microfluidic device of claim 1, further comprising a hydrophobic patch disposed in the microchannel.

23. The microfluidic device of claim 22, wherein the hydrophobic patch is arranged substantially co-axially with the fluid interface port.

24. The microfluidic device of claim 1, wherein the microchannel comprises a semi-open channel structure formed in a substrate.

25. The microfluidic device of claim 24, further comprising a cover for covering the semi-open channel structure to form an enclosed microchannel, the enclosed microchannel forming the interior bounded by the side wall, the side wall being formed by the substrate and the cover.

26. The microfluidic device of claim 25, wherein the fluid interface port is formed in the cover.

27. The microfluidic device of claim 1, further comprising an ejector coupled to the microchannel for ejecting a droplet of a fluid disposed in the microchannel through the virtual wall in the interface port.

28. The microfluidic device of claim 27, wherein the ejector comprises at least one of a pressure pulse generator for applying a pressure pulse to the fluid to eject the droplet thereof through the virtual wall formed in the fluid interface port, a gas pressurizer, a voltage generator, and a heater located opposite the virtual wall for heating a fluid to produce a gas bubble, wherein the gas bubble ejects a droplet of the fluid through the virtual wall.

29. A microfluidic device, comprising:

a microchannel having an interior bounded by a side wall; and

a first fluid interface port formed in the side wall of the microchannel to provide access to the interior of the microchannel, such that when a fluid is disposed in the interior of the microchannel, the fluid forms a virtual wall at the first fluid interface port, wherein the microchannel is free of a second coaxially arranged fluid interface port formed in the side wall at a location opposite to the first fluid interface port.

30. The microfluidic device of claim 29, wherein the microchannel and the fluid interface port each have a diameter, wherein the diameter of the fluid interface port is substantially equal to the diameter of the microchannel.

31. The microfluidic device of claim 30, wherein the diameter of the fluid interface port is between about 25 μm and about 100 μm.

32. The microfluidic device of claim 29, wherein the fluid interface port has an inner wall comprising a material that is repellent to the fluid disposed in the interior of the microchannel.

33. The microfluidic device of claim 32, wherein the material comprises a hydrophobic material.

34. The microfluidic device of claim 29, wherein an interior surface of the side wall of the microchannel is attractive to the fluid disposed in the interior of the microchannel.

35. The microfluidic device of claim 34, wherein the interior surface of the side wall is formed of a hydrophilic material.

36. The microfluidic device of claim 29, further comprising a covering layer disposed over the fluid interface port for covering the fluid interface port.

37. The microfluidic device of claim 36, wherein the covering layer comprises a covering fluid that is immiscible with the fluid disposed in the interior of the microchannel.

38. The microfluidic device of claim 36, wherein the covering layer comprises a non-evaporating liquid.

39. The microfluidic device of claim 29, further comprising a selected other fluid interface port formed in the side wall of the microchannel, such that when a fluid is disposed in the interior of the microchannel, the fluid forms a virtual wall in the selected other fluid interface port.

40. The microfluidic device of claim 39, wherein the fluid interface port forms an injection port for receiving a sample and passing the sample into the interior of the microchannel, and the selected other fluid interface port forms an ejection port for ejecting a sample from the microchannel.

41. The microfluidic device of claim 29, further comprising a droplet generating system for forming a droplet of the fluid and for introducing the droplet to the channel through the fluid interface port.

42. The microfluidic device of claim 41, wherein the droplet generating system comprises a droplet carrying element for carrying the droplet.

43. The microfluidic device of claim 42, wherein the droplet carrying element comprises a pin for introducing the droplet to the fluid interface port by contacting the virtual wall.

44. The microfluidic device of claim 29, further comprising an optical detector disposed relative to the fluid interfacing port for optically detecting the fluid through the virtual wall formed in the fluid interface port.

45. The microfluidic device of claim 29, further comprising an array of fluid interface ports forming a plurality of virtual walls, wherein the array of fluid interface ports wicks an externally applied second liquid into the microchannel.

46. The microfluidic device of claim 29, wherein the fluid interface port has a cylindrical or conical shape.

47. The microfluidic device of claim 29, further comprising a first fluid disposed in the interior of the channel and forming a virtual wall in the fluid interface port.

48. The microfluidic device of claim 29, wherein the fluid interface port is adapted to allow the bi-directional exchange of fluid with the microchannel through the fluid interface port.

49. The microfluidic device of claim 29, wherein the microchannel is non-linear in shape.

50. The microfluidic device of claim 29, wherein the microchannel is substantially U-shaped.

51. The microfluidic device of claim 29, further comprising a hydrophobic patch disposed in the microchannel.

52. The microfluidic device of claim 51, wherein the hydrophobic patch is arranged substantially co-axially with the fluid interface port.

53. The microfluidic device of claim 29, wherein the microchannel comprises a semi-open channel structure formed in a substrate.

54. The microfluidic device of claim 53, further comprising a cover for covering the semi-open channel structure to form an enclosed microchannel, the enclosed microchannel forming the interior bounded by the side wall, the side wall being formed by the substrate and the cover.

55. The microfluidic device of claim 54, wherein the fluid interface port is formed in the cover.

56. The microfluidic device of claim 29, further comprising an ejector coupled to the microchannel for ejecting a droplet of a fluid disposed in the microchannel through the virtual wall in the interface port.

57. The microfluidic device of claim 56, wherein the ejector comprises at least one of a pressure pulse generator for applying a pressure pulse to the fluid to eject the droplet thereof through the virtual wall formed in the fluid interface port, a gas pressurizer, a voltage generator, and a heater located opposite the virtual wall for heating a fluid to produce a gas bubble, wherein the gas bubble ejects a droplet of the fluid through the virtual wall.

58. A microfluidic device, comprising:

a microchannel defining an interior bounded by a side wall; and

a fluid interface port formed in the side wall of the microchannel to provide access to the interior of the microchannel, such that when a fluid is disposed in

the interior of the microchannel, the fluid forms a virtual wall in the fluid interface port, wherein the fluid interface port has a dead volume that is less than one nanoliter.

59. The microfluidic device of claim 58, wherein the dead volume of the fluid interface port is less than about a picoliter.

60. The microfluidic device of claim 58, wherein the microchannel is free of a second coaxially arranged fluid interface port formed in the side wall at a location opposite to the first fluid interface port.

61. The microfluidic device of claim 58, wherein the microchannel and the fluid interface port each have a diameter, wherein the diameter of the fluid interface port is substantially equal to the diameter of the microchannel.

62. The microfluidic device of claim 61, wherein the diameter of the fluid interface port is between about 25 μm and about 150 μm.

63. The microfluidic device of claim 62, wherein the diameter of the fluid interface port is between about 50 μm and about 100 μm.

64. The microfluidic device of claim 58, wherein the fluid interface port has an inner wall comprising a material that is repellent to the fluid disposed in the interior of the microchannel.

65. The microfluidic device of claim 64, wherein the material comprises a hydrophobic material.

66. The microfluidic device of claim 58, wherein an interior surface of the side wall of the microchannel is attractive to the fluid disposed in the interior of the microchannel.

67. The microfluidic device of claim 66, wherein the interior surface of the side wall is formed of a hydrophilic material.

68. The microfluidic device of claim 58, further comprising a covering layer disposed over the fluid interface port for covering the fluid interface port.

69. The microfluidic device of claim 68, wherein the covering layer comprises a covering fluid that is immiscible with the fluid disposed in the interior of the microchannel.

70. The microfluidic device of claim 68, wherein the covering layer comprises a non-evaporating liquid.

71. The microfluidic device of claim 58, further comprising a selected other fluid interface port formed in the side wall of the microchannel, such that when a fluid is disposed in the interior of the microchannel, the fluid forms a virtual wall in the selected other fluid interface port.

72. The microfluidic device of claim 71, wherein the fluid interface port forms an injection port for receiving a sample and passing the sample into the interior of the microchannel, and the selected other fluid interface port forms an ejection port for ejecting a sample from the microchannel.

73. The microfluidic device of claim 58, further comprising a droplet generating system for forming a droplet of the fluid and for introducing the droplet to the channel through the fluid interface port.

74. The microfluidic device of claim 73, wherein the droplet generating system comprises a droplet carrying element for carrying the droplet.

75. The microfluidic device of claim 74, wherein the droplet carrying element comprises a pin for introducing the droplet to the fluid interface port by contacting the virtual wall.

76. The microfluidic device of claim 58, further comprising an optical detector disposed relative to the fluid interfacing port for optically detecting the fluid through the virtual wall formed in the fluid interface port.

77. The microfluidic device of claim 58, further comprising an array of fluid interface ports forming a plurality of virtual walls, wherein the array of fluid interface ports wicks an externally applied second liquid into the microchannel.

78. The microfluidic device of claim 58, wherein the fluid interface port has a cylindrical or conical shape.

79. The microfluidic device of claim 58, further comprising a first fluid disposed in the interior of the channel and forming a virtual wall in the fluid interface port.

80. The microfluidic device of claim 58, wherein the fluid interface port is adapted to allow the bi-directional exchange of fluid with the microchannel through the fluid interface port.

81. The microfluidic device of claim 58, wherein the microchannel is non-linear in shape.

82. The microfluidic device of claim 58, wherein the microchannel is substantially U-shaped.

83. The microfluidic device of claim 58, further comprising a hydrophobic patch disposed in the microchannel.

84. The microfluidic device of claim 83, wherein the hydrophobic patch is arranged substantially co-axially with the fluid interface port.

85. The microfluidic device of claim 58, wherein the microchannel comprises a semi-open channel structure formed in a substrate.

86. The microfluidic device of claim 85, further comprising a cover for covering the semi-open channel structure to form an enclosed microchannel, the enclosed microchannel forming the interior bounded by the side wall, the side wall being formed by the substrate and the cover.

87. The microfluidic device of claim 86, wherein the fluid interface port is formed in the cover.

88. The microfluidic device of claim 58, further comprising an ejector coupled to the microchannel for ejecting a droplet of a fluid disposed in the microchannel through the virtual wall in the interface port.

89. The microfluidic device of claim 88, wherein the ejector comprises at least one of a pressure pulse generator for applying a pressure pulse to the fluid to eject the droplet thereof through the virtual wall formed in the fluid interface port, a gas pressurizer, a voltage generator, and a heater located opposite the virtual wall for heating a fluid to produce a gas bubble, wherein the gas bubble ejects a droplet of the fluid through the virtual wall.

90. A microfluidic device, comprising:

a microchannel defining an interior bounded by a side wall; and

a fluid interface port formed in the side wall of the microchannel to provide access to the interior of the microchannel, such that when a fluid is disposed in the interior of the microchannel, the fluid forms a virtual wall in the fluid interface port, wherein the fluid interface port has zero dead volume.

91. The microfluidic device of claim 90, wherein the microchannel is free of a second coaxially arranged fluid interface port formed in the side wall at a location opposite to the first fluid interface port.

92. The microfluidic device of claim 90, wherein the microchannel and the fluid interface port each have a diameter, wherein the diameter of the fluid interface port is substantially equal to the diameter of the microchannel.

93. The microfluidic device of claim 92, wherein the diameter of the fluid interface port is between about 25 μm and about 100 μm.

94. The microfluidic device of claim 90, wherein the fluid interface port has an inner wall comprising a material that is repellent to the fluid disposed in the interior of the microchannel.

95. The microfluidic device of claim 94, wherein the material comprises a hydrophobic material.

96. The microfluidic device of claim 90, wherein an interior surface of the side wall of the microchannel is attractive to the fluid disposed in the interior of the microchannel.

97. The microfluidic device of claim 96, wherein the interior surface of the side wall is formed of a hydrophilic material.

98. The microfluidic device of claim 90, further comprising a covering layer disposed over the fluid interface port for covering the fluid interface port.

99. The microfluidic device of claim 98, wherein the covering layer comprises a covering fluid that is immiscible with the fluid disposed in the interior of the microchannel.

100. The microfluidic device of claim 98, wherein the covering layer comprises a non-evaporating liquid.

101. The microfluidic device of claim 90, further comprising a selected other fluid interface port formed in the side wall of the microchannel, such that when a fluid is

disposed in the interior of the microchannel, the fluid forms a virtual wall in the selected other fluid interface port.

102. The microfluidic device of claim 101, wherein the fluid interface port forms an injection port for receiving a sample and passing the sample into the interior of the microchannel, and the selected other fluid interface port forms an ejection port for ejecting a sample from the microchannel.

103. The microfluidic device of claim 90, further comprising a droplet generating system for forming a droplet of the fluid and for introducing the droplet to the channel through the fluid interface port.

104. The microfluidic device of claim 103, wherein the droplet generating system comprises a droplet carrying element for carrying the droplet.

105. The microfluidic device of claim 104, wherein the droplet carrying element comprises a pin for introducing the droplet to the fluid interface port by contacting the virtual wall.

106. The microfluidic device of claim 90, further comprising an optical detector disposed relative to the fluid interfacing port for optically detecting the fluid through the virtual wall formed in the fluid interface port.

107. The microfluidic device of claim 90, further comprising an array of fluid interface ports forming a plurality of virtual walls, wherein the array of fluid interface ports wicks an externally applied second liquid into the microchannel.

108. The microfluidic device of claim 90, wherein the fluid interface port has a cylindrical or conical shape.

109. The microfluidic device of claim 90, further comprising a first fluid disposed in the interior of the channel and forming a virtual wall in the fluid interface port.

110. The microfluidic device of claim 90, wherein the fluid interface port is adapted to allow the bi-directional exchange of fluid with the microchannel through the fluid interface port.

111. The microfluidic device of claim 90, wherein the microchannel is non-linear in shape.

112. The microfluidic device of claim 90, wherein the microchannel is substantially U-shaped.

113. The microfluidic device of claim 90, further comprising a hydrophobic patch disposed in the microchannel.

114. The microfluidic device of claim 113, wherein the hydrophobic patch is arranged substantially co-axially with the fluid interface port.

115. The microfluidic device of claim 90, wherein the microchannel comprises a semi-open channel structure formed in a substrate.

116. The microfluidic device of claim 115, further comprising a cover for covering the semi-open channel structure to form an enclosed microchannel, the enclosed microchannel forming the interior bounded by the side wall, the side wall being formed by the substrate and the cover.

117. The microfluidic device of claim 116, wherein the fluid interface port is formed in the cover.

118. The microfluidic device of claim 90, further comprising an ejector coupled to the microchannel for ejecting a droplet of a fluid disposed in the microchannel through the virtual wall in the interface port.

119. The microfluidic device of claim 118, wherein the ejector comprises at least one of a pressure pulse generator for applying a pressure pulse to the fluid to eject the droplet thereof through the virtual wall formed in the fluid interface port, a gas pressurizer, a voltage generator, and a heater located opposite the virtual wall for heating a fluid to produce a gas bubble, wherein the gas bubble ejects a droplet of the fluid through the virtual wall.

120. A microfluidic device, comprising:

a microchannel having an interior bounded by a side wall; and

a fluid interface port formed in the side wall of the microchannel to provide access to the interior of the microchannel, wherein the fluid interface is sized and dimensioned such that when a fluid is disposed in the interior of the microchannel, the fluid forms a virtual wall at the fluid interface port, said virtual wall being employed as an optical window for optically analyzing the fluid in the microchannel.

121. The microfluidic device of claim 120, further comprising an optical detector disposed relative to the fluid interface port for optically analyzing the fluid through the virtual wall formed in the fluid interface port.

122. The microfluidic device of claim 120, further comprising

an optical element disposed relative to the optical window to allow an optical signal from the fluid to pass therethrough, and

an optical detector disposed relative to the optical element for measuring the optical signal from the fluid passing through the optical element.

123. The microfluidic device of claim 120, wherein the microchannel and the fluid interface port each have a diameter, wherein the diameter of the fluid interface port is substantially equal to the diameter of the microchannel.

124. The microfluidic device of claim 120, wherein the fluid interface port has an inner wall comprising a material that is repellent to the fluid disposed in the interior of the microchannel.

125. The microfluidic device of claim 124, wherein the material comprises a hydrophobic material.

126. The microfluidic device of claim 120, wherein an interior surface of the side wall of the microchannel is attractive to the fluid disposed in the interior of the microchannel.

127. The microfluidic device of claim 126, wherein the interior surface of the side wall is formed of a hydrophilic material.

128. The microfluidic device of claim 120, further comprising a covering layer disposed over the fluid interface port for covering the fluid interface port.

129. The microfluidic device of claim 128, wherein the covering layer comprises a covering fluid that is immiscible with the fluid disposed in the interior of the microchannel.

130. The microfluidic device of claim 128, wherein the covering layer comprises a non-evaporating liquid.

131. The microfluidic device of claim 120, further comprising a second fluid interface port formed in the side wall of the microchannel, such that the fluid in the interior of the microchannel forms a virtual wall in the second fluid interface port.

132. The microfluidic device of claim 131, wherein the fluid interface port forms an injection port for receiving a sample and passing the sample into the interior of the microchannel, and the second fluid interface port forms an ejection port for ejecting a sample from the microchannel.

133. The microfluidic device of claim 120, further comprising a droplet generating system for forming a droplet of the fluid and for introducing the droplet to the channel through the fluid interface port.

134. The microfluidic device of claim 133, wherein the droplet generating system comprises a droplet carrying element for carrying the droplet.

135. The microfluidic device of claim 134, wherein the droplet carrying element comprises a pin for introducing the droplet to the fluid interface port by contacting the virtual wall.

136. The microfluidic device of claim 120, further comprising an array of fluid interface ports forming a plurality of virtual walls, wherein the array of fluid interface ports wicks an externally applied second liquid into the microchannel.

137. The microfluidic device of claim 120, wherein the fluid interface port has a cylindrical or conical shape.

138. The microfluidic device of claim 120, further comprising a first fluid disposed in the interior of the channel and forming a virtual wall in the fluid interface port.

139. The microfluidic device of claim 120, wherein the fluid interface port is adapted to allow the bi-directional exchange of fluid with the microchannel through the fluid interface port.

140. The microfluidic device of claim 120, wherein the microchannel is non-linear in shape.

141. The microfluidic device of claim 140, wherein the microchannel is substantially U-shaped.

142. The microfluidic device of claim 120, further comprising a hydrophobic patch disposed in the microchannel.

143. The microfluidic device of claim 142, wherein the hydrophobic patch is arranged substantially co-axially with the fluid interface port.

144. The microfluidic device of claim 90, wherein the microchannel comprises a semi-open channel structure formed in a substrate.

145. The microfluidic device of claim 144, further comprising a cover for covering the semi-open channel structure to form an enclosed microchannel, the enclosed microchannel forming the interior bounded by the side wall, the side wall being formed by the substrate and the cover.

146. The microfluidic device of claim 145, wherein the fluid interface port is formed in the cover.

147. The microfluidic device of claim 120, further comprising an ejector coupled to the microchannel for ejecting a droplet of a fluid in the microchannel through the virtual wall formed in the fluid interface port.

148. The microfluidic device of claim 147, wherein the ejector comprises at least one of a pressure pulse generator for applying a pressure pulse to the fluid to eject the droplet thereof through the virtual wall formed in the fluid interface port, a gas pressurizer, a voltage generator, and a heater located opposite the virtual wall for heating a fluid to produce a gas bubble, wherein the gas bubble ejects a droplet of the fluid through the virtual wall.

149. The microfluidic device of claim 120, further comprising a second fluid interface port disposed opposite to the fluid interface port and coaxially arranged therewith.

150. The microfluidic device of claim 149, further comprising

a first optical element disposed relative to the optical window to allow optical energy to pass therethrough,

a second optical element disposed relative to the second interface port to allow optical energy to pass therethrough, and

an optical detector disposed relative to one of the first and second optical elements for optically detecting the optical energy from the fluid in the microchannel passing through the optical element.

151. A liquid volume injection system for injecting a droplet into a microchannel of a fluidic system, said system comprising:

a droplet generator system for generating the droplet; and

a virtual wall formed in a fluid interface port by a fluid disposed in the microchannel for receiving the droplet.

152. The system of claim 151, further comprising a droplet guiding system for directing the droplet toward the virtual wall.

153. The system of claim 151, wherein the droplet generator comprises a nozzle assembly.

154. The system of claim 153, wherein the nozzle assembly comprises a breaking off point where the droplet is formed, and the system further comprises a droplet charger comprises a charging circuit and a droplet electrode for charging the droplet at the breaking off point.

155. The system of claim 152, wherein the droplet guiding system comprises a droplet charger for charging the droplet and including a droplet electrode.

156. The system of claim 155, wherein the droplet charger further comprises a droplet charging circuit connected to the droplet electrode.

157. The system of claim 155, wherein the droplet charger further comprises a ground electrode for guiding the charged droplet.

158. The system of claim 152, wherein the droplet guiding system comprises one or more electrically controlled deflection plates for establishing an electric field to direct the droplet to the virtual wall.

159. The system of claim 151, further comprising an array of fluid interfacing ports forming a virtual wall in each said fluid interface port.

160. The system of claim 152, wherein the droplet guiding system comprises a channel charging circuit for selectively providing a charge to the microchannel.

161. The system of claim 160, wherein the channel charging circuit charges the fluid channel to attract the charged droplet.

162. The system of claim 161, wherein the channel charging circuit charges a neighboring fluid channel to repel the charged droplet.

163. The system of claim 152, wherein the droplet guiding system comprises a targeting electrode adjacent to the virtual wall for targeting charged droplets towards the virtual wall.

164. The system of claim 163, further comprising a targeting electrode charging circuit for charging the targeting electrode.

165. An electrokinetically operated microfluidic system, comprising:

a microchannel for housing a fluid having a side wall, and a fluid interface port formed in the side wall, wherein the fluid forms a virtual wall within the fluid interface port;

a first reservoir including a first electrode connected to a first end of the microchannel;

a second reservoir including a second electrode connected to a second end of the microchannel; and

a voltage generator for establishing an electric field between the first electrode and the second electrode, thereby inducing movement of the first fluid through the microchannel.

166. The system of claim 165, further comprising a droplet generator system for generating a droplet containing a liquid volume to be introduced into the microchannel through the virtual wall.

167. The system of claim 166, wherein the applied electric field in the microchannel effects an electrophoretic separation of the liquid volume into individual constituents.

168. The system of claim 167, further comprising a detector coupled to the microchannel for detecting the individual constituents of the liquid volume in the microchannel.

169. The system of claim 168, further comprising a second virtual wall formed in a second fluid interface port formed in the microchannel for forming an optical detection window for the detector.

170. The system of claim 165, further comprising a plurality of microchannels connected to the first and second reservoirs.

171. The system of claim 165, further comprising a second virtual wall formed in a second fluid interface port in the microchannel for ejecting the fluid from the microchannel.

172. The system of claim 165, wherein the first and second reservoirs are formed in a base substrate.

173. The system of claim 172, wherein said microchannel is formed in said base substrate and extends between said first and second reservoirs and is in fluid communication with said first and second reservoirs.

174. The system of claim 172, further comprising a microchannel assembly disposed in a hollow portion of said base substrate between said first and second reservoirs.

175. The system of claim 174, wherein said microchannel assembly comprises a first channel substrate having one or more microchannels formed therein, and

a second channel substrate stacked with said first channel substrate, thereby defining said microchannels, wherein said fluid interface ports are formed in said second channel substrate and are in registration with one or more of said microchannels.

176. The system of claim 175, wherein said second channel substrate comprises a cover.

177. The system of claim 174, wherein the microchannel assembly comprises a plurality of parallel microchannels.

178. The system of claim 165, further comprising one or more microreactors disposed along said microchannel for effecting a chemical reaction in the microchannel.

179. A microfluidic device, comprising:

a microchannel having an interior bounded by a side wall; and

one or more sample introduction ports formed in the side wall of the microchannel to provide access to the interior of the microchannel, such that a fluid disposed in the interior of the microchannel forms a virtual wall at the fluid interface port, and

a filling aperture formed in the side wall of the microchannel for filling the microchannel with the fluid.

180. The device of claim 179, further comprising an encapsulant for filling the filling aperture.

181. The device of claim 179, further comprising a closing layer for covering the filling aperture.

182. A microfluidic device, comprising:

a microchannel having an interior bounded by a side wall; and

one or more fluid interface ports formed in the side wall of the microchannel to provide access to the interior of the microchannel, such that a fluid disposed in the interior of the microchannel forms a virtual wall at the fluid interface port, said fluid ports being sized and dimensioned for pumping the fluid in the channel when a liquid is introduced to the fluid interface port.

183. The device of claim 182, further comprising a hydrophobic patch disposed in the microchannel to induce the fluid to flow in a particular direction, thereby facilitating the pumping of the fluid in the channel.

184. The device of claim 182, wherein said channel has a closed end, thereby facilitating the pumping of the fluid in the channel.

185. The device of claim 182, further comprising a stopper hole formed in the side wall of the microchannel to form a pressure barrier therein to force the fluid in a selected direction.

186. A microfluidic device, comprising:

a microchannel having an interior bounded by a side wall; and

a hydrophobic patch disposed on an interior surface of the side wall of the microchannel; and

a fluid interface port formed in the side wall opposite the hydrophobic patch to provide access to the interior of the microchannel, wherein the fluid interface port forms a vent for allowing air to escape the interior of the microchannel.

187. The microfluidic device of claim 186, wherein the fluid interface port comprises an aperture having a diameter between about 25 um and about 100 um.

188. The microfluidic device of claim 186, further comprising a covering layer for covering the fluid interface port.

189. The microfluidic device of claim 186, wherein the hydrophobic patch is applied through the fluid interface port.

190. A microfluidic device, comprising :

a microchannel having an interior bounded by a side wall;

a fluid interface port formed in the side wall of the microchannel to provide access to the interior of the microchannel, wherein the fluid interface port is sized and dimensioned such that when a fluid is disposed in the interior of the microchannel, the fluid forms a virtual wall at the fluid interface port;

at least one waste channel in communication with and intersecting the microchannel to collect waste from the microchannel.

191. The microfluidic device of claim 190, wherein the microchannel has an inlet for a washing medium disposed upstream from the fluid interface port and having a first diameter.

192. The microfluidic device of claim 191, wherein the microchannel has an outlet disposed downstream from the waste channel and having a second diameter.

193. The microfluidic device of claim 192, further comprising a washing medium flowing through the microchannel interior.

194. The microfluidic device of claim 193, wherein a sample introduced into the washing medium via the virtual wall diffuses into the washing medium, such that the components of the sample are separated according to size.

195. The microfluidic device of claim 194, wherein the waste channel is sized and positioned to collect particles in the sample having a first selected size.

196. The microfluidic device of claim 195, wherein the outlet sized and positioned to collect particles having a second selected size.